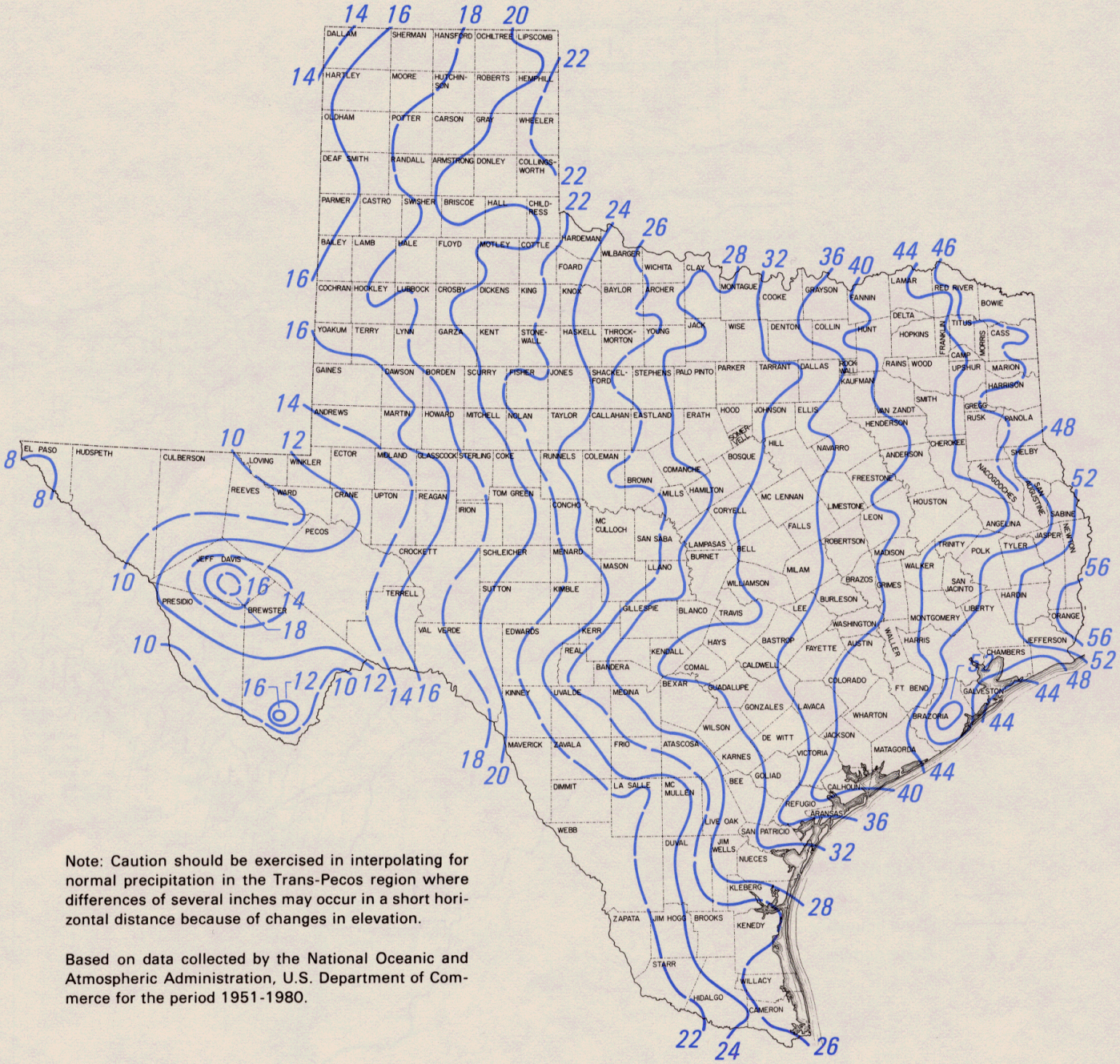

Figure 5. Normal Annual Precipitation (Inches)

expanded program area that involves hazardous waste disposal permits, underground injection control, "cradle to grave" tracking of wastes, identification and clean-up of abandoned waste sites (federal Superfund actions), and the Texas Oil and Hazardous Substances Pollution Contingency Plan for rapid State response to emergencies and accidental spills.

The federal Resource Conservation and Recovery Act of 1976 directed the development of a national hazardous waste management program by the U.S. Environmental Protection Agency (EPA). The Act also established a procedure whereby the EPA could authorize a state to implement a consistent state program in lieu of the federal program. The Texas Hazardous Waste Management Program satisfies both State and federal requirements, and is being implemented with financial assistance and oversight from the EPA. The Texas Solid Waste Disposal Act defines a hazardous waste as a discarded material of a solid, liquid, semi-solid or contained gaseous form that can cause or

significantly contribute to serious illness or death, or that poses a substantial threat to human health or the environment when improperly managed. Under this State Act, the Department of Water Resources and the Department of Health are, respectively, delegated the responsibilities for management of industrial solid wastes and municipal solid wastes.

The EPA has also awarded the Department's Underground Injection Control Program primary authority to permit, monitor, and enforce regulations associated with such activities as solution mining projects and municipal and industrial waste disposal well operations. The Department has issued over 200 permits for the underground injection of liquid wastes into deep salt water aquifers, and there are currently 140 active permits for these waste disposal (Class I injection well) projects. Industrial wastes disposed of by deep well injection are typically low volume wastes that are not readily amenable to disposal by such methods as incineration or treatment and discharge into the State's waterways. In addition, there are more than 70 brine solution mining projects, 30 uranium mines, 4 sulphur mines, and 3 sodium sulfate mines which together account for more than 200 separate injection wells in Texas that are being permitted under this State program.

The Department has determined that both groundwater and surface-water resources can be adequately protected from contamination (pollution) if the injected fluids are confined to suitable subsurface strata that are not hydrologically connected with useable freshwater aquifers, provided injection pressures are within defined limits and injection wells are properly designed and operated. After permits are issued, the Department is also responsible for monitoring operational compliance of these injection well projects. At present, underground injection wells are being used in Texas for disposal of municipal and industrial wastes, storage of natural gas and petroleum products in subterranean caverns, operation of heat-pump systems, recovery of minerals by solution mining, injection of excess rural (agricultural) and urban runoff, secondary oil and gas recovery, and brine disposal of brines associated with oil and gas production.

Floodplain Management

All of the 254 counties in Texas have been designated by the Federal Emergency Management Agency as having some flood prone areas in which human life and property are subject to flooding risks. Many of the counties and cities have adopted local floodplain management programs in compliance with federal requirements regarding participation in the National Flood Insurance Program (NFIP). As of June 1984, 661 cities, 108 counties, and 12 special purpose districts had chosen to participate in the NFIP. Participation in the NFIP makes flood insurance available to residents presently residing within floodplains in these areas and affords some degree of protection against monetary losses due to flooding. To qualify for the NFIP, political subdivisions must comply with the requirements and criteria of the program. These requirements encourage sound land use by minimizing exposure of property to flood losses.

Bays and Estuaries

Texas has 11 major river basins which are associated with bays and estuaries of primary importance. There are 7 major and several minor estuaries distributed along the 400 miles of Texas Gulf coastline (Figure 6). Texas estuaries are generally characterized as drowned river mouths (the results of an ancient rise in sea level), and are complemented by elongate barrier islands that enclose about 1.5 million surface acres of open water and at least an additional 1.1 million acres of marshes and tidal flats. These coastal environments produce over 100 million pounds per year of seafoods harvested by sport and commercial fishermen. At this level of fishing activity, the total annual impact on the Texas economy is currently about $1.25 billion (1980 dollars). Virtually all of the coastal fisheries species are considered to be estuarine-dependent during at least some portion of their life cycles. The estuaries, in turn, are dependent on freshwater flows from Texas streams and rivers for sediments, nutrients, and a viable salinity gradient that allows inhabiting organisms to survive, grow, and reproduce.

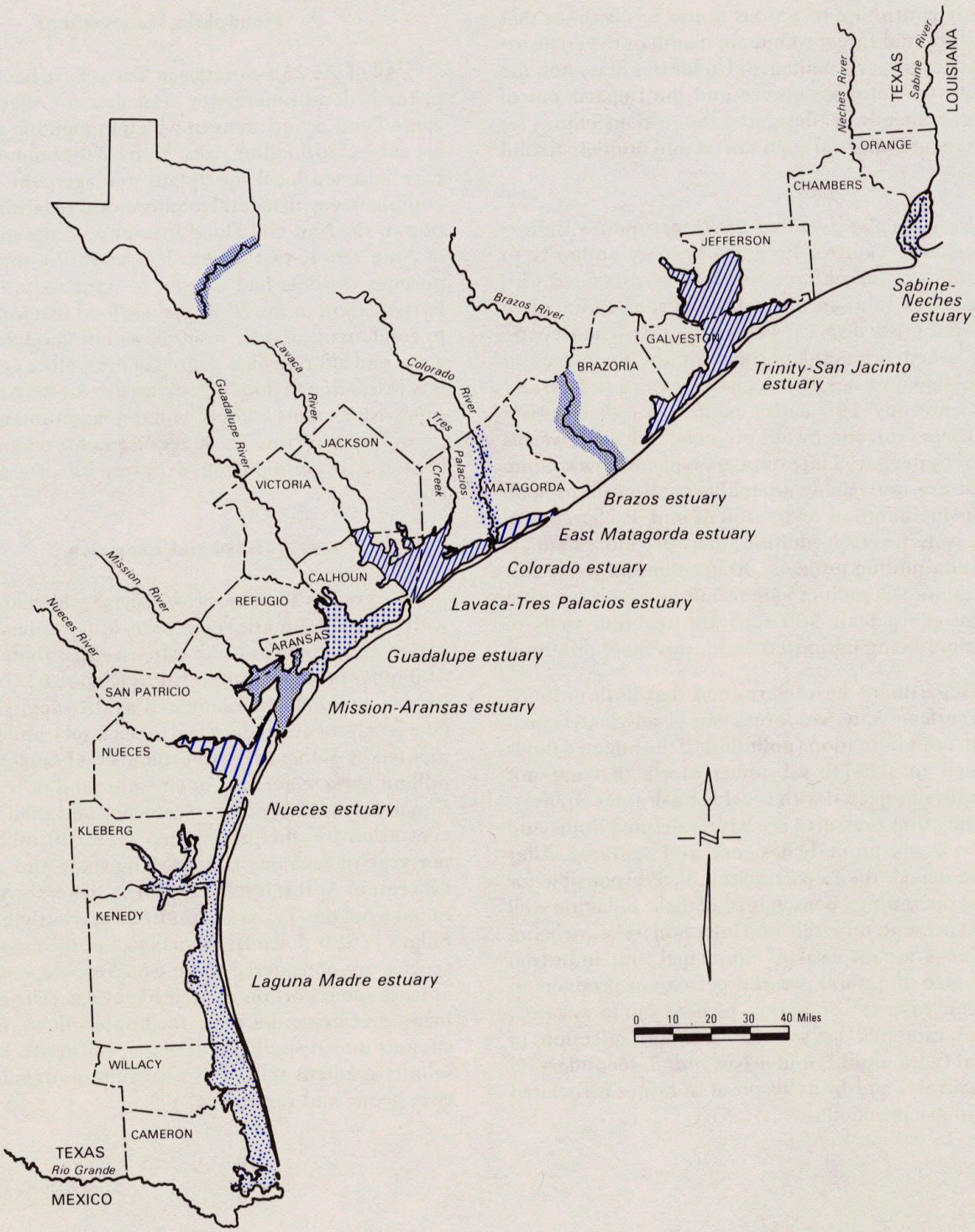

Figure 6. Locations of Texas Estuaries